BULLETIN
ENGINEERING DEPARTMENT
NATIONAL LAMP WORKS
OF GENERAL ELECTRIC CO.

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Bulletin 28

SHOW-WINDOW LIGHTING

Presenting in a General Way the Essentials of Good Show-Window Lighting, Emphasizing Especially the Possibilities of Light Direction and Color.

Show-Window Lighting

The ultimate purpose of a show window is to create a desire to purchase. It may do this directly, by displaying objects which when seen by an observer are desired at once, or, indirectly, by imparting to the observer a desire to inspect further the establishment of which the show window is a part. A show window usually appears as a picture in which the window-dresser has endeavored to portray one object or a group of objects in such a manner that the display has the power to draw and to hold the attention by appealing to the observer's sense of beauty or of the unusual. At night, the degree to which this is accomplished depends not only upon the display itself, but upon the manner in which it is illuminated.

This bulletin treats the problem of show-window lighting under three main divisions:

1—Fundamental Considerations;
2—Light Direction, Color, and Intensity;
3—Practical Installation Suggestions.

The principles discussed will be found to apply to any window which the reader may call to mind.

Fundamental Considerations

When a show window is lighted by suspending bare lamps just above the goods so that the lamps are directly in the range of vision, it is impossible to obtain a clear view of the display regardless of the intensity used. Such an effect may have the tendency to make an observer look away from the window rather than toward it. Examples of such lighting are in evidence in nearly every community. If bare lamps are suspended high, well out of the line of vision, the actual intensity of illumination on the display will be decreased, but the absence of glare will permit the goods to be viewed to much better advantage.

When a show window is illuminated by lamps without reflectors, the display receives direct light from the lamps and also some light which is reflected from the ceiling, background, etc. As a rule, show-window ceilings and backgrounds are poor reflecting surfaces so that little reflected light reaches the display. For this reason, such installations are inefficient. If, however, the lamps are

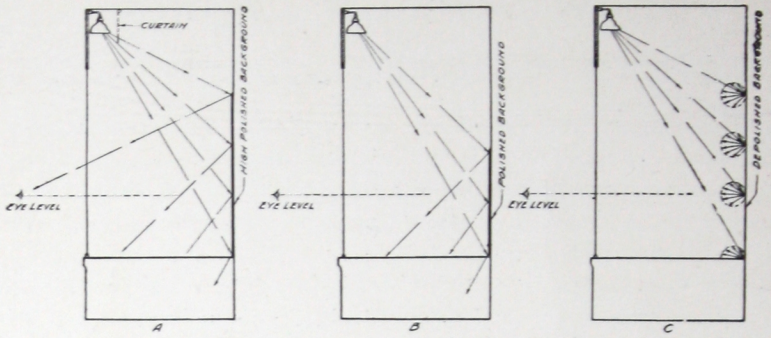

Fig. 1—Diagram Showing the Effect of Window Backgrounds as Regards to Specular Reflection

equipped with proper reflectors which direct the light where it is needed, the efficiency of the installation will be increased.

As far as the amount of illumination is concerned, the hanging height of the lamps makes little difference provided the proper reflector is chosen and the light sources are concealed; it is important, however, that the units be concealed, for a show-window should attract attention to the display rather than to the light sources. If the window glass does not extend all the way up to the ceiling, there may be room to mount the units along the top front edge so that they cannot be seen from the sidewalk. If conditions are otherwise, it may be necessary to drop a curtain or valance next to the glass for a foot or two from the ceiling. A translucent sign extending across the top of the glass illuminated from behind by the lamps which light the window may be utilized in some cases to advantage.

Reflections of light sources from polished surfaces are sometimes of such brilliancy that they produce a blinding effect almost as extreme as would the light source itself. If a lamp is placed as shown in Sketch A, Fig. 1, in a window with a polished background, such as a mirror or a polished wood paneling which extends almost from the floor of the window to the ceiling, the image of the source will be reflected into the eye of the observer as shown by the broken lines. If the background does not extend up so high, as in Sketch B, Fig. 1, little reflected light will strike the eye at its ordinary height. The same result can be secured by dropping a curtain between the light sources and a high background as indicated in Sketch A, Fig. 1; or, if the background is a necessary part of the display, it may be mat-finished so that the reflection instead of

forming a brilliant image will be diffused in all directions as shown in Sketch C, Fig. 1. When light is reflected from mat surfaces in all directions, the whole surface appears uniformly illuminated and no excessively brilliant image is formed to dazzle the eye.

Another source of annoyance to the observer of a show window, either by day or by night, is the reflection in the window glass of bright objects on the street, or lights from nearby buildings and windows. In many instances this cannot be easily remedied. However, by the use of curved window glass, such as is shown in Fig. 2, this condition of direct reflection can be avoided and the attractiveness of the show window be preserved.

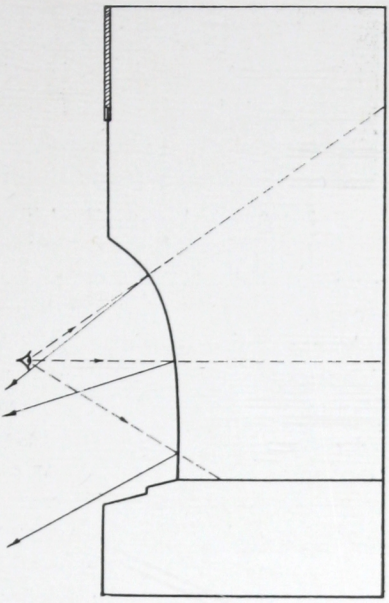

Fig. 2—Curved Window Glass Prevents Direct Reflections

Light Direction, Color, and Intensity

Light Direction

A certain degree of shadow is necessary in order that each part of an object may appear in its proper relation to every other part. If a window is illuminated in such a way that all shadow is avoided, the display is certain to appear flat. The importance of shadow in lighting is well illustrated by the photographs of Fig. 3. The first four illustrations on the left show various expressions of the Laocoön head brought about by varying the direction of incident light; the last two illustrations show the flattening effect of diffused light. On the other hand, if the usual display were illuminated by a single large unit mounted at the ceiling near the glass, the contrast of light and shade might be too pronounced. It is well, therefore, to have available a greater number of smaller units employing, in most cases, the 100-watt MAZDA C-1 or 150-watt MAZDA C-2 lamps mounted along the top front edge of the window. It is a great advantage to have installed two or three times as many outlets as are needed for any one form of lighting. These should be wired in groups so that the direction of the light can be varied to

Fig. 3—The Laocoon Head Illuminated from Different Directions
From "Light and Shade" by M. Luckiesh

secure any degree of light and shade by merely using the proper groups. In those cases of window lighting where striking effects of light and shade contrasts are desirable, advantage can be taken of this special construction and placing of units. For instance, a display may have a central figure which demands a more pronounced contrast of light and shade than could be secured with a uniform spacing of units. For such an effect, several units may be grouped as shown in Fig. 4. This arrangmenet of units gives the central figure its proper appearance, and at the same time prevents objectionable shadows on the remainder of the display. Again, a display may consist only of one object. Many times heavy shadows will show such a display to the best advantage, and in such a case the display can be best lighted by placing a large lamp with a reflector in one of the upper front corners of the window.

Changes in the direction of the light which illuminates a window may be made to alter the appearance of a display to such an extent that the value of this particular display may be equal to that of several different displays. The effect of changing light direction may be demonstrated and utilized by confining it to a small booth within the window. In this way, the regular wiring of the window need not be altered. An ordinary box with an opening in one side may be covered inside and out with black cloth. Several lamps equipped with reflectors pointing toward the center of the back of the box can be mounted inside at intervals around the opening, in such a manner that the light sources are concealed; the wires to each lamp should be separate. A small flasher may be used to light each lamp in rotation or in any order desired. Any suitable object mounted on a small

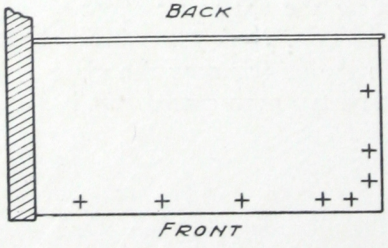

Fig. 4—Suggested Layout for Securing Highlights

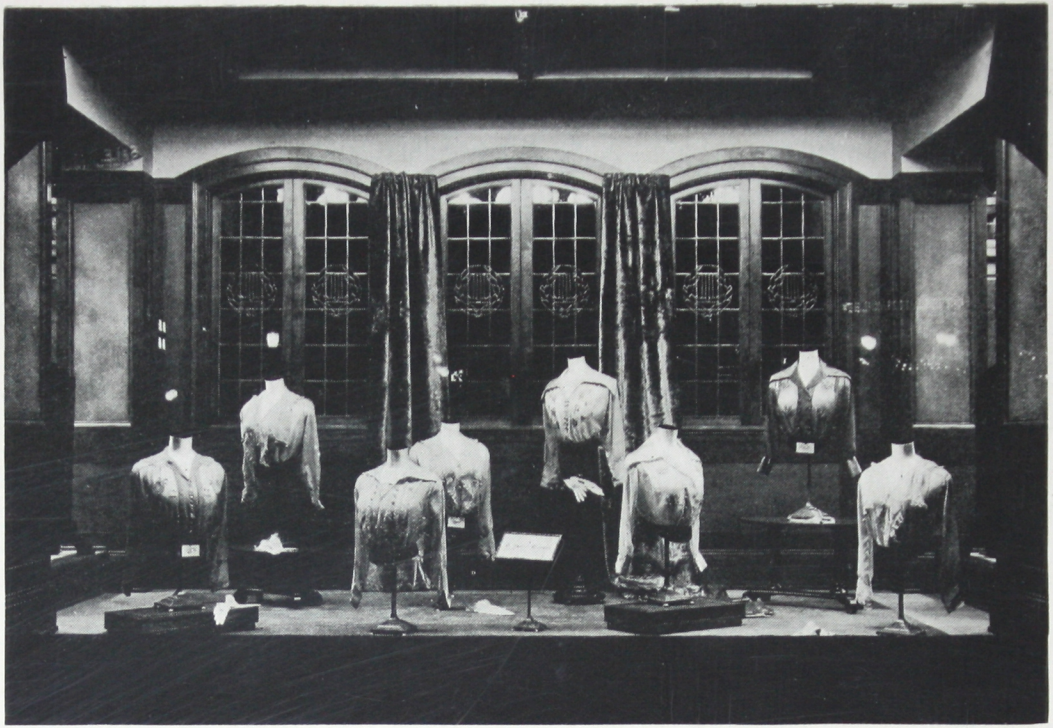

Fig. 5—A Show Window Well Lighted with MAZDA C-2 Lamps. The Pleasing Background Adds Much to the General Effect

Fig. 6—A Well Lighted Window is very Valuable to the Small Store

pedestal at the back of the box toward which the reflectors point, will be strikingly transformed as the direction of the light changes. A still simpler display can be arranged by using only two or three lighting units at widely different positions and employing automatic socket flashers.

Color

Color is, of course, one of the show-window dresser's most effective tools, yet full advantage is seldom taken of the possibilities of artificial lighting in the rendition of colors. The color contrast in a display depends, among other things, upon the color quality of the light which is used. A ribbon is said to be red in daylight because it absorbs practically all the other colors in the spectrum and reflects mainly the red. Under a green or a blue light in which red rays are absent, the same ribbon would appear almost black. MAZDA lamps give all the colors of the spectrum but their light contains relatively more of red and yellow rays than does daylight. Hence, these lamps emphasize the reds, yellows, and browns and likewise fail to bring out the blues and violets in their proper weight. By the careful selection of color screens, however, any color may be given emphasis. Thus, for instance, if it is desirable to emphasize the whiteness of goods on display or to bring out the blues in dress goods, a color screen should be used which will absorb a part of the excess red and yellow rays while freely permitting the others to pass. Blue-green glass of the proper selection will do this, but if correct color value of the light

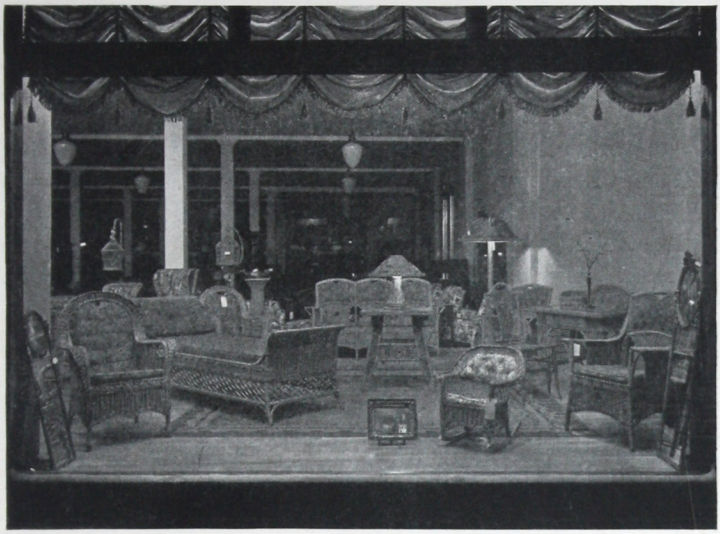

Fig. 7—Show-Window Lighting with MAZDA C-2 Lamps as Applied to the Window Show Room

and a high efficiency are to be obtained, a thorough knowledge of color must be used in the selection. Lamps, designated as MAZDA C-2* lamps, have been developed which, through the effect of special coloring elements mixed with the ingredients of the glass from which the bulbs are blown, give a light of afternoon sunlight quality at about the efficiency of the MAZDA B lamp. The lamp manufacturer has placed the proper color in the bulb instead of depending on auxiliary equipment, since other glass having the same appearance as that used in MAZDA C-2 lamps might, to the user's disadvantage, transmit light of very different color value.

Color variation is, perhaps, the most effective means of holding attention. A florist's window, for example, can be made to change wonderfully by simply changing the color quality of the light which illuminates it. If it is lighted entirely by a white light, such as is obtained with MAZDA C-2 lamps, the whites, blues, greens, and violets will appear to stand out because the reds, yellows, and browns with which they are contrasted will be depressed. If the color quality of the light is made to change by adding to the white light, brown and yellow light from amber-colored bulbs, the colors

*The MAZDA C-2 lamp should not be confused with the MAZDA C-3 lamp, which is designed especially for photographic purposes. Although both have the blue bulb, they do not give light of the same color quality.

that first appeared prominent will appear to fade and the yellows and browns will be given prominence. Again, if red light is added to the white light, the effect will be to make the contrasts between red and the other colors more marked. Such effects, as mentioned, may be readily secured by having available in the window the colored lamps necessary. The changes from one color to another may be sudden and contrasting, or they may be gradual and harmonious. The colors in rugs, dress goods, wall paper, pictures, paintings, etc., are susceptible to the same treatment. A window-dresser who will make a study of the possibilities of colored light as well as the possibilities of light direction will be able to produce beautiful and unusual effects.

Intensity

The light required to produce a suitable intensity for show-window lighting depends, among other things, upon the brightness of the street as a whole. A display which is located on a relatively dark side street where other windows are unlighted will require less illumination than one which is located on a brightly lighted street where the buildings and windows are well illuminated. Further, objects are seen not by the light which strikes them but by the light which they reflect; hence, a window in which dark goods are displayed must be illuminated to several times the intensity of a window in which white goods are displayed to appear lighted to an equal intensity. A light-colored show-window display in a small town might be well lighted at an intensity of 10 foot-candles, a similar display on a prominent street in a city might profitably use 25 foot-candles, while for a dark display under the latter conditions, 50 foot-candles might well be employed. The range of intensities, then, which are suitable for show-window lighting may be given as 10 to 50 foot-candles, depending on the color of the display and the relative brightness of the window surroundings.

A decided variation in the intensity of illumination can be made to draw attention to a special feature of a display as well as to the window as a whole. For instance, in a window which was designed to feature talking machines, the window was trimmed as a typical living room with an instrument standing in a rear corner and a figure sitting comfortably in a chair in a listening attitude A portable lamp was placed on a convenient table so as to give sufficient light to show the corner dimly illuminated, yet leaving the remainder of the window in almost total darkness. At the

Fig. 8—A Well Lighted Window Showing the Proper Use of Mirrors in the Background. The Lighting Unit Visible near the Center of the Window is an Image of a Street Lamp

Fig. 9—A Valance Draped Irregularly may Add to the Appearance of the Show-Window

opposite side of the window, the various models of the instrument were arranged with such descriptive signs as were necessary. The lighting system was so designed that by means of a flasher the whole window was first lighted for an instant, then darkened for an instant and this was followed by the lighting of the portable lamp. The lighting of the whole window attracted attention to the display of the machines; the whole window becoming dark served to increase the interest in the window, and the lighting of the portable lamp served to center the interest on the instrument in use under home conditions and thereby bring to the observer's mind the place the instrument would take in his home.

Practical Installation Suggestions

Reflectors

Although the necessity for efficient reflectors has been mentioned above, little has been said regarding what constitutes a good reflector for display-window lighting. Briefly, such a reflector should concentrate a maximum of the light from the lamp upon the dis-

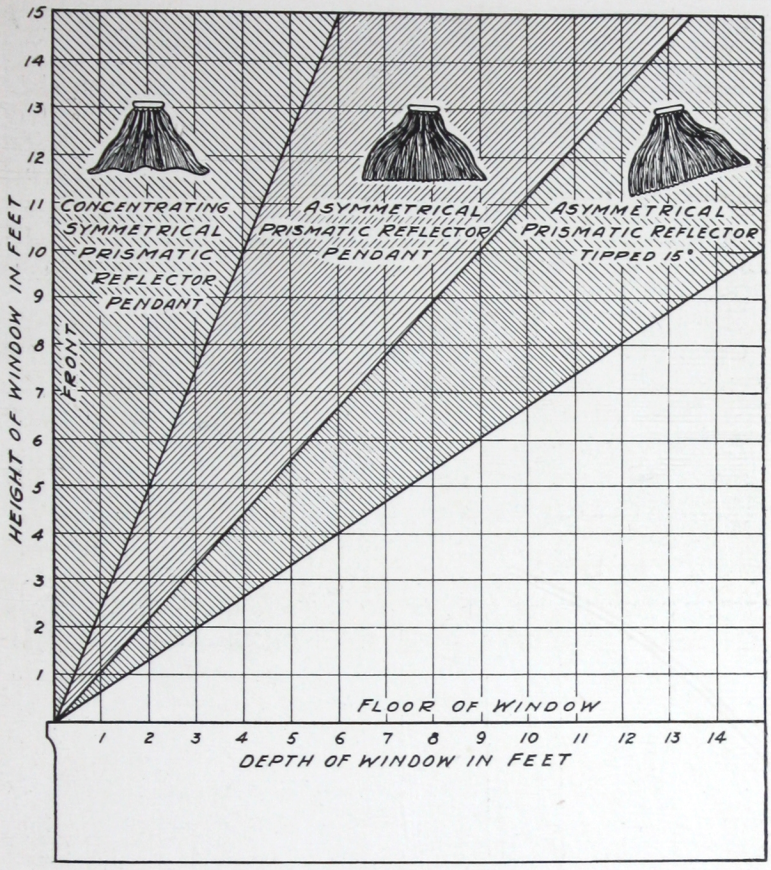

Fig. 10—Chart Designed to Aid in the Selection of Prismatic Reflectors for Show-Window Lighting

play; it should have a permanent reflecting surface; it should be of a type which is easily cleaned; and it should be moderate in cost. Tests which have been conducted by the Engineering Department on many types of reflectors used in connection with MAZDA C lamps, indicate that prismatic-glass and mirrored-glass reflectors are the most satisfactory for this class of work. Since the filament of the MAZDA C lamp is highly concentrated, it permits very accurate control of the light with these reflectors. This is accomplished in the prismatic-glass reflectors by properly designed prisms, and in the mirrored reflectors by the mirrored surface. The prismatic reflector is, of course, permanently efficient and not difficult

Fig. 11—A Long, Shallow Window Well Lighted

to clean. In choosing mirrored reflectors, great care should be taken to insure that those selected will not deteriorate with age for, while excellent types are available, others have this serious fault.

Reflector manufacturers have developed charts to help the user of reflectors in selecting the proper equipment for any size of window. Such a chart, applying to the prismatic reflector, is shown in Fig. 10. It is only necessary to lay out on the chart the proportions of the window and note the recommendations applying to the angle within which the upper inside corner falls. The chart shown is based upon the use of either 100-watt MAZDA C-1 or 150-watt MAZDA C-2 lamps in the reflectors specified, since these lamps, because of their high efficiency, excellent color quality, and small size, are particularly well adapted to this purpose.

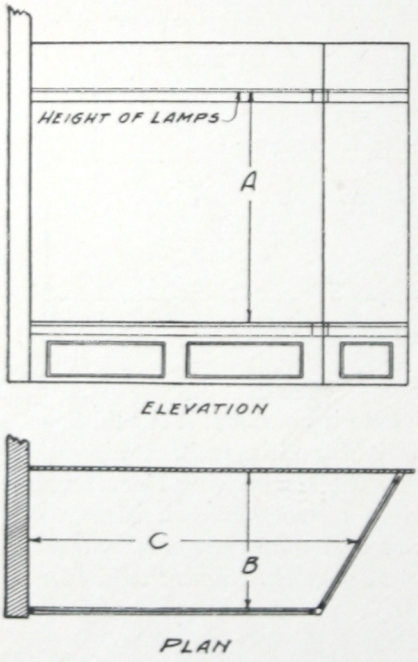

Fig. 12—Diagram of Show Window, Showing Important Dimensions

Wattage Required

The number of lamps required, at any one time, to give the proper intensity for any show window can be computed by a simple method. However, it should be remembered that sockets and wiring for two or three times the computed number should be installed if possible. Where it is not possible to have a flexible

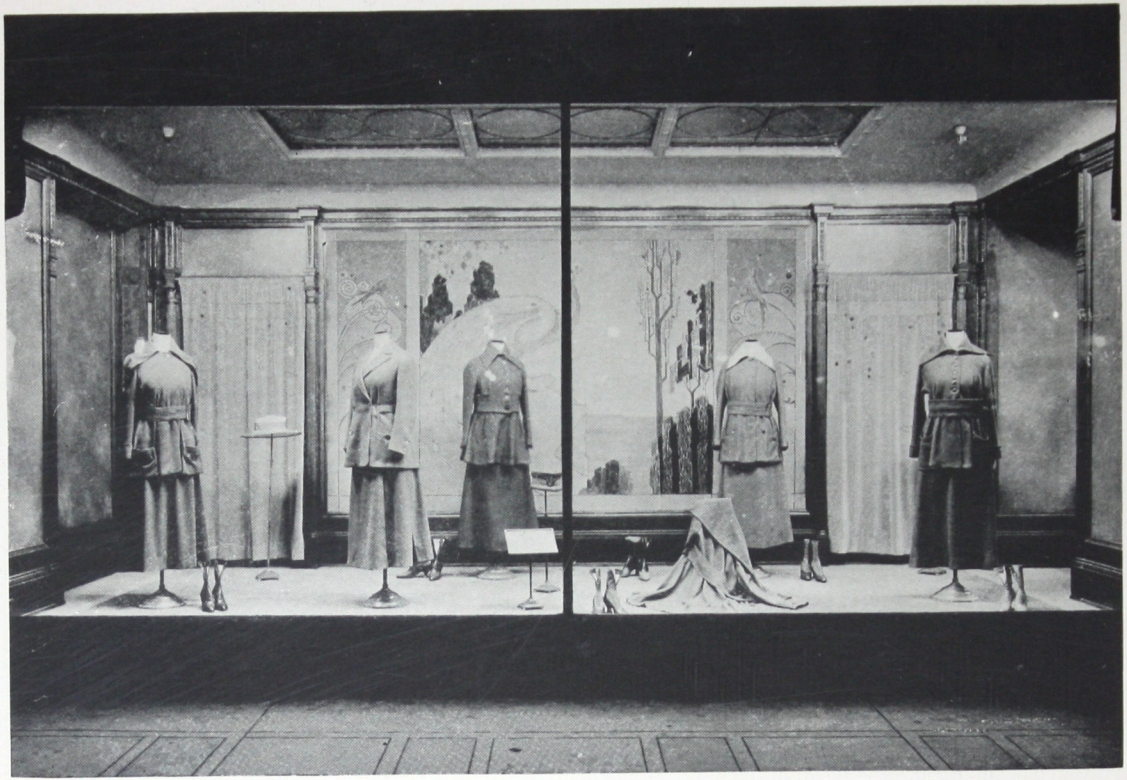

Fig. 13—This Show Window is Well Lighted with MAZDA C-2 Lamps. The Light-Colored Mat-Finished Background Increases the Apparent Intensity and Prevents Specular Reflections

Fig. 14—Specular Reflection in the Polished Surface of the Upper Background and the Visibility of Reflectors Detract from the General Effect of this Otherwise Well Lighted Window. A Curtain Draped in the Rear of the Reflectors as shown in Sketch A, Fig. 1 would Eliminate the Objectionable Features

arrangement of units, the lamps should be located as recommended in the following example. For the purpose of calculation, show windows may be divided into ten classes on the basis of intensity of illumination desired. Class 1 includes those windows in which the lowest standard of illumination is wanted—an intensity, in fact which would not be adequate in most cases. Class 2 includes the average country store, where a low intensity is sufficient. Classes 5 and 6 cover the average store, and Classes 7 and 8, the department stores of most cities. The finest windows of the largest stores and exclusive shops located on brightly lighted streets fall in Class 9 or 10, representing the highest intensities which can be used to direct advantage.

The first step in the calculation is to place the specified window in one of the ten classes. The next step is to add the depth of the window, in feet, to the height of the lamps above the window floor, in feet, and multiply this sum by the class number of the window. The result will give the required watts per running foot of the window frontage assuming that 100-watt MAZDA C-1 lamps are to be used. To get the number of lamps necessary, the number of watts per running foot of window frontage should be multiplied by the window frontage in feet and this result divided by 100. Should the window be such as shown in Fig. 12 other than rectangular in shape, the length of the window frontage should be taken as the average of the length of the actual window front and the length of the window background. This method of calculation as described applies only where windows are to be lighted by a direct system using well designed mirrored-glass or prismatic reflectors placed at the top of the window. Where MAZDA C-2 lamps are to be used, the 150-watt size is recommended. Since the light output of the 150-watt MAZDA C-2 lamp is approximately the same as that of the 100-watt MAZDA C-1 lamp, due to the absorption by the colored bulb, the number of units to be used is the same in either case. As an example of the use of this method, a specific problem may be of interest.

Example

It is desired to illuminate a show window of a hardware store in a town of about 10,000 inhabitants. Fig. 12 shows both plan and elevation of the window.

Size of window:
- Height (A) ..... 10 feet
- Depth (B) ..... 6 feet
- Length of front ..... 12 feet
- Length of back ..... 16 feet
- Length of side glass ..... 6½ feet

Class No. 4
Height + Depth = 10 + 6 = ... 16 feet
Watts per running foot of window front, Class No. x 16 = 4x16 = ... 64
Length of window front to be used (average of front and background lengths, C) ..... 14 feet
Total wattage to be used, 14x64 = ... 896
Number of 100-watt MAZDA C-1 lamps = 896 ÷ 100 = ... 8.96
*Actual number of 100 watt MAZDA C-1 lamps used = ... 9
Total window length considered in spacing lamps = front window length + side window length = 12 + 6½ = ... 18½

$$\text{Spacing distance of units} = \frac{18\frac{1}{2}}{9} = \ldots\ldots \text{2 feet (approximate)}$$

*If 150-watt C-2 lamps were preferred, calculation will show that the same number of units per window will be required.

From the chart of Fig. 10, it is seen that the asymmetrical reflector should be used hung pendant. Six units would be placed along the front of the window, three along the front of the side-window; these would be screened from view. If the show-window floor had been rectangular instead of the shape shown in Fig. 12, all lamps would have been placed at equal intervals along the front top edge of the window.

In conclusion, it should be emphasized that the problem of show-window lighting in its broadest sense is not merely one of getting light on the displayed merchandise; it includes the controlling of light direction and color. That the concealment of light sources and the use of reflectors is essential to all good show-window illumination is generally recognized, but to the principles of light direction and light color little attention has been given. Therefore, as these principles together with the considerations mentioned heretofore are applied in the lighting of show windows, a marked improvement in this art may be anticipated.

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